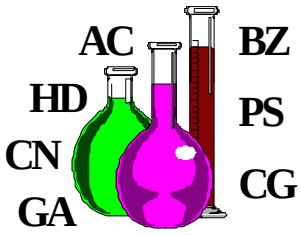
U.S. Army Center for Health Promotion and Preventive Medicine

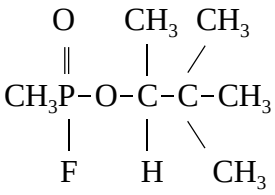


Detailed Facts About Nerve Agent GD

#218-04-0696

Physical Properties of Nerve Agent GD

Chemical Structure



Chemical Formula $C_7H_{16}FO_2P$

Description GD-type nerve agents are clear, colorless, and tasteless liquids. They have a slight camphor odor and give off a colorless vapor.

Molecular Weight 182.2

Boiling Point 167° - 200°C

Vapor Pressure (mm Hg) 0.40 @ 25°C

Freezing Point -42°C

Density Liquid = 1.02
Vapor = 5.6 (air = 1)

Solubility <15G/L

Flash Point 121°C (Open cup)

Volatility 531 mg/m^3 @ 0°C
3,900 mg/m^3 @ 25°C
5,570 mg/m^3 @ 30°C

Agent GD - The chemical phosphonofluoridic acid, metyl-1, 2, 2-trimethylpropyl ester, Chemical Abstract Service Registry No. 96-64-0.

Toxicity Values	ICt_{50} (inhalation)	= 35 mg-min/m^3 (15 l/min)
	LC_{50} (inhalation)	= 70 mg-min/m^3 (15 l/min)
	LD_{50} (percutaneous, bare skin)	= 5 mg/kg

Exposure Limits

Workplace Time-Weighted Average -	0.00003 mg/m^3
General Population Limits -	0.000003 mg/m^3

Toxic Properties of Nerve Agent GD

G-type agents stored in the unitary stockpile are in ton containers, artillery shells, mortar projectiles, rockets, and land mines.

GD is a lethal anticholinesterase agent. Although it is primarily a vapor hazard, its toxic hazard is high for inhalation, ingestion, and eye and skin exposure. Its rate of detoxification in the body is low.

Overexposure Effects

Signs and symptoms are the same regardless of route the poison enters the body (by inhalation, absorption, or ingestion): runny nose; tightness of chest; dimness of vision and miosis (pinpointing of the eye pupils); difficulty in breathing; drooling and excessive sweating; nausea; vomiting; cramps, and involuntary defecation and urination; twitching, jerking, and staggering; and headache, confusion, drowsiness, coma, and convulsion. These signs and symptoms are followed by cessation of breathing and death.

Emergency and First Aid Procedures

Inhalation: hold breath and don respiratory protection mask; if severe signs of agent exposure appear, administer immediately, in rapid succession, all three Nerve Agent Antidote Kits, Mark I injectors; use mouth-to-mouth resuscitation when approved mask-bag or oxygen delivery systems are not available, but do not use mouth-to-mouth resuscitation when facial contamination exists; administer oxygen if breathing is difficult; seek medical attention immediately.

Eye Contact: flush eyes immediately with water for 10-15 minutes then don a respiratory protective mask. Although miosis may be an early sign of agent exposure, do not administer an injection when miosis is the only sign present; seek medical attention immediately.

Skin Contact: don respiratory mask and remove contaminated clothing; wash contaminated skin with copious amounts of soap and water immediately using 10 percent sodium carbonate solution, or 5 percent liquid household bleach; rinse well with water to remove decontamination; administer an instramuscular injection with the Mark I Kit if local sweating and muscular symptoms occur; seek medical attention immediately.

Ingestion: do not induce vomiting; first symptoms are likely to be gastrointestinal; administer immediately 2 milligrams intramuscular injection of the MARK I Kit auto injectors; seek medical attention immediately.

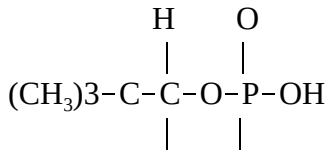
Protective Equipment

Protective Gloves:	Wear Butyl Glove M3 and M4 Norton, Chemical Protective Glove Set.
Eye Protection:	Wear chemical goggles; use goggles and faceshield for splash hazards.
Other:	Wear gloves and lab coat with M9 or M17 mask readily available for general lab work.

Reactivity Data

Stability: Stable after storage in steel for 3 months at 65°C. GD corrodes steel at the rate of 1 x 10^{-5} inch/month; ~12 hours.

GD will hydrolyze to form HF and



Hazardous Polymerization: Will not occur.

Persistency Depends upon munitions used and the weather. Heavily splashed liquid persists 1 to 2 days under average weather conditions.

References

1. Department of the Army Pamphlet (DA PAM) 40-8, *Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents, GA, GB, GD, and VX,* December 1990.

2. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.

3. Army Regulation (AR) 385-61, *The Army Toxic Chemical Agent Safety Program*, July 1983.

4. U.S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study,* 15 September 1993.

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